

**INTERNAL RADIATION DOSE, REDWING
PROJECT 2.66a PARTICIPANTS**

One of the objectives of Project 2.66a, Early Cloud Penetration, was to obtain specific information regarding internal doses resulting from inhalation of radioactive material during flights through "atomic" clouds. Two methods were used to collect such data: The analysis of urine samples and whole-body counting.

URINE SAMPLE RESULTS. A urine sample was collected from each participant during the 24-hour period immediately following his penetration flight. Samples were also collected from individuals not exposed to radiation and from individuals at Enewetak who did not participate in the penetration flights in order to establish a baseline or background level. These samples were flown to the Los Alamos Scientific Laboratory (LASL) for evaluation on the first available flight.

The gross beta analysis of these samples revealed that except for those individuals who penetrated the Shot APACHE cloud, all beta activity detected was attributable to the excretion of Potassium-40 (K-40), a naturally occurring radio-nuclide in the body. The highest gross beta activity found in an APACHE participant was 29,100 disintegrations per minute (800 ml sample). Subtracting the normal daily K-40 excretion (4,450 dpm) results in a net beta activity of 24,650 dpm or 0.011 microcuries. The project report (WT-1320) concluded that such a level was too low to constitute an internal radiation hazard.

To put this result into perspective, let us assume that all of the net beta activity results from I-131 (see following section), which is readily analyzed from such a urine sample. Using I-131 retention equations found in TM-190, the ICRP lung model, and dose conversion factors found in ICRP Report 30, we can equate this urine sample result to a 50-year committed dose equivalent of less than 150 millirem to the thyroid.

The urine samples were also analyzed for Plutonium-239 at LASL. The highest activity measured (0.87 dpm/l) corresponds to a 50-year committed dose equivalent to

DNA1.940923.031

the bone of less than one rem. Sample residues were subsequently sent to the Lamont Geophysical Laboratory at Columbia University to be analyzed for Strontium-90. According to WT-1320, the results were insignificant.

WHOLE-BODY COUNTER RESULTS. Each test participant reported to LASL for a whole-body count prior to the operation and within 5 to 10 days after his penetration flight. The average pre-shot high energy gamma count for the entire group (20 individuals), was 490 ± 50 disintegrations per second. Post shot counts for the group averaged 600 ± 100 disintegrations per second. The increase was primarily attributable to four individuals who had flown through the APACHE cloud.

Two of the APACHE participants who showed increases of more than 1000 disintegrations per second were re-examined at Argonne National Laboratories where it was determined that a significant contribution to the whole-body count resulted from contamination on external body surfaces, primarily the hair. This suggested that these individuals may have been exposed to a period of fallout on the residence islands in addition to their flights through the cloud. Unfortunately, no similar study was made on the other two APACHE participants with excess counts. It should be noted that the residence islands did experience fallout (approximately 20 mR/hr at H+4 hours) from Shot MOHAWK which was detonated six days prior to APACHE and a lesser amount from APACHE itself.

Assuming that all of the activity measured by the whole-body counter resulted from internal contamination, the maximum level of high energy gamma emitter in the body (body burden) was less than 0.07 microcuries. I-131 is an appropriate fission product radionuclide to scope a high-sided organ dose because of its abundance at the time of interest (several days after fission), nearly 10 percent of the total activity; its organ specificity (the thyroid); and the low mass of the thyroid, which increases the organ dose (dose expresses absorbed energy per unit mass). Taking the entire body burden as Iodine-131 in the thyroid, the 50-year committed dose equivalent to the thyroid would be less than 1 rem. Therefore, the whole-body counts confirmed the conclusion that internal doses resulting from radioactive material inhaled or ingested during flights through REDWING clouds are negligible.